Art. III.—*Growth stages in modern Trigonias, belonging to the section Pectinatae.*

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The molluscan genus Trigonia Bruguière, has been divided into a series of sections which, though well marked, yet merge into one another so that Lycett considered it inadvisable to erect them into genera or even sub-genera.[1] The living Australian species, he says, are a group apart, and to the section formed by them the name Pectinatae or Pectinidae has been applied. Lycett refers T. subundulata, Jenkins (=T. semiundulata, McCoy), to the same group. The resemblance of this fossil form to the members of the section Costatae had previously been called attention to, but Lycett points out that it differs from that group in that its valves are equal and similar in ornament, whereas in the Costatae a separate description for the two valves is required. It would then appear justifiable to refer all our modern Australian Trigonias to the same group.

The question of the discrimination of our recent species is one of difficulty, for considerable variation is shown both in the shape of the shells and in their ornament, and, probably, the last has not been heard on the question. Four species seem to be generally accepted—T. strangei, T. lamarckii, T. margaritacea, and T. uniophora. To these McCoy added T. acuticostata which he originally described as a fossil, and Tenison Woods described a variety of T. lamarckii to which he applied the name reticulata.[2] Whether this variety is distinct from McCoy's acuticostata and whether that is or is not a variety of a living species I am not prepared to say.

The species from our tertiary beds are: T. subundulata, Jenkins; T. intersitans, Tate (=T. tatei, Pritchard); T. tubulifera, Tate;

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1 Palæontographical Society, 1872.

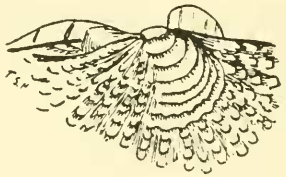
2 Proc. Linn. Soc. N. S. Wales, vol. ii., 1877, p. 125.

T. acuticostata, M'Coy; T. howitti, McCoy, and T. murravica, Tate, the latter being very closely allied to T. howitti.[1]

The recent species are all characterised by the possession of radial ornament alone, concentric ridging being absent, and this feature also occurs in the more recent of the fossil forms, namely T. acuticostata, T. howitti and T. murravica. The remainder, the older members of the group, have a discrepant ornament, radial ridging appearing on the posterior third of the shell and concentric on the anterior part. It is this discrepant ornament which seems to ally them with the more ancient fossil forms, more particularly with Jurassic ones. A close alliance, however, as we have seen, is denied by Lycett, who grouped one of the most typical of those with discrepant ornament, namely, T. subundulata, with the modern radially ribbed Pectinidae. Since Lycett wrote, our other two older tertiary species have been added to the list and belong to the same group.

An examination of the young shells of several of the radially ribbed species shows the justness of Lycett's grouping, for, in all that I have been able to examine, discrepant ornament occurs.

In T. margaritacea the prodissoconch measures 0·2 mm. in breadth, and is smooth.



Trigonia margaritacea, umbonal portion of right valve of a young specimen.

This stage is marked off from the succeeding one, the brephic, by a margining ridge. From this till the shell is about 1 mm. in breadth it has discrepant ornament. On the anterior half of the shell a series of concentric ridges is developed, which are sharp, almost lamellar, marked off by broad, shallow, concave grooves, and separated from one another by some four or five times the width of the ridges. Of these ridges some eight or nine occur.

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1 Trans. Roy. Soc. South Australia, vol. xix., 1895, p. 202.

The posterior slope has four or five radiating ridges, which at first are smooth, but soon become nodulose, the most posterior ones being the first to assume this character. As growth proceeds, additional radiating ridges or costulae are intercalated at varying distances from the prodissoconch. The concentric ridges or costae on the anterior part of the shell eventually become broken up into nodules, which later become radially confluent and assume the character of the radiating nodulose ridges of the adult, soon taking on their specific form.

A usually strongly marked feature of the genus is the presence of distinct ridge running from the umbo to the lower posterior angle of the shell, and known as the marginal carina. In the adults of the recent species this marginal carina is comparatively inconspicuous, but in the brephic stage of the present species, T. margaritacea, its position is distinctly marked by a bold radial ridge, which is more pronounced than those posterior to it.

Just as the most dorsal of the posterior radiating ridges are the first to assume the nodulose character of the adult, so the concentric ridges give place to radial ones beginning with their posterior ends, and the ancestral character of discrepant ornament persists longest in the more anterior part of the shell.

Carrying our observations a step further and passing by the adult or ephebic stage—"the period of full development of the individual, when all specific characters are clearly recognizable" —we reach the gerontic stage of Messrs. Buckman and Bather, or the senile of other authors, when "changes take place which are due to a gradual failure of powers." In T. margaritacea the nodules on the radiating ridges become more crowded and less prominent, till finally they disappear among the increasingly rugose lines of growth, while the radiating ridges themselves also fade away and vanish. These signs of failing powers are first shown in the siphonal area, and are here most strongly marked; while towards the anterior the nodules and ridges persist much longer.

In T. lamarckii the stages are similar, the brephic stage showing discrepant ornament.

In T. acuticostata the prodissoconch is like that of T. margaritacea, but the concentric ridges of the brephic stage persist till the shell has attained a breadth of 1·5 mm., and

are about twelve in number. The longer persistence of this character in the fossil is of interest, but my series is too small to say whether we have here a constant difference from T. lamarckii, the species to which it is said to be most closely allied.

Though I have a fairly large number of specimens of T. howitti all have abraded umbos, but a specimen in the cabinet of Rev. A. W. Cresswell shows that, like its congeners it also had discrepant ornament in its youth.

I was anxious to find out if the remaining recent species exhibited the same characters, and, as our Melbourne Museum did not contain the material, I wrote to Mr. C. Hedley, of Sydney, asking him to supply my deficiencies. It appeared that recently Mr. Hedley's attention had been turned to the same point, but he informed me that, as far as he had been able to find out, the facts had not been recorded, and he generously urged me to publish my results.

The drawing is from a young specimen of T. margaritacea given me by Mr. J. H. Gatliff, and to his kindness I also owe an example of T. lamarckii, and the opportunity of examining a series in his cabinet.

If we assume, as seems probable, that concentric ornament is the more archaic form, and due to the accentuation of the incremental lines, and that radial sculpture originated as a breaking up of these lines, then we find, in the Pectinatae, the archaic sculpture persisting longer in the anterior region of the shell, and the more modern first appearing towards the posterior. In the older members of the group, as typified by T. subundulata, this archaic ornamentation persists throughout life towards the anterior end, while in the more modern members it disappears at the close of the brephic stage, being entirely replaced by the more modern form of sculpture. Similarly, in the posterior region the signs of old age first make their appearance, and from thence gradually pass towards the front.

In the older members of the Pectinatae some interesting variations occur. Thus, in T. subundulosa some individuals even from the same stratum, show that the radial lines have transgressed beyond the marginal carina and appear as grooves crossing the concentric costae, thus breaking up the costae into oblong, flattened nodules. The extent to which this occurs is

very variable in different individuals. It may be absent, scarcely discernible, or well marked. In T. intersitans the character is much more advanced, though even here great individual variation occurs. As regards the only other of our species with discrepant ornament, T. tubulifera, I am unable to speak in this respect. The species is small and closely beset with tubular spines, so that the matrix is apt to adhere closely. Pofessor Tate in his original description speaks of one specimen in which the discrepant ornament was scarcely traceable, while in another it was well marked.

SUMMARY.

The recent species, T. margaritacea, T. lamarckii, and the miocene species, T. acuticostata and T. howitti, which are all radially ribbed, show ancestral characters in the discrepant ornament of the brephic stage. The older members of the group Pectinatae, namely, T. subundulosa and T. intersitans, show, in some individuals, a progress towards the ornamentation of the more modern forms. The whole of the facts support the justice of assembling all the species into the single group known as Pectinatae.